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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte A-JUNG KIM

Appeal 2007-2437
Application 09/816,080
Technology Center 2100

Oral Hearing Held: September 11, 2007

Before JOSEPH L. DIXON, ROBERT E. NAPPI, and JOHN A. JEFFERY, *Administrative Patent Judges.*

ON BEHALF OF THE APPELLANT:

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JUDGE DIXON: Good morning, counsel. You have twenty minutes for your presentation.

MR. WIELAND: I appreciate the time. Okay. I -- every time I've been to the Board, the Board has been -- as I am, so I'm going to dispense with any discussion about the background or anything and launch right into

the arguments, if that's okay. Naturally, you can ask any questions and I'll stop and go back. What we have is a cryptographic system, and I'm going to use the nomenclature used in cryptography of Alice being the sender, Bob being the receiver and Eve being the eavesdropper. This is actually in the patent. It's actually common, but it's in the Meyers (phonetic sp.) patent. In that system, what we have is Alice sends out a key. Now a key is just what you would think it is. It's a key to decryption, but it can't be intercepted because if the key is intercepted, it's a major problem. You don't have the security you want. So Alice sends, starts sending out this key, and is 11001000111. Bob, on the other hand, is receiving these binary values. But it's a noisy environment. For double E's, we always try to suppress noise. We try to treat it. We try to do a lot of different things like clean up the signal, filter out the noise, amplify what you get, even interpolate and extrapolate the values so that you can clean up the values that you get. This invention actually turns that around. It actually has the insiders saying, noise is our friend, we can use noise very effectively here, because what we hear at Bob's site, is the signal's coming in, but he's not getting them very clearly. There's noise, there's background. There always is because it's a multiple access system. So he's getting this noise in and he's setting a threshold. And the ones that are above the threshold he's recording. Now what's neat about this is Eve sitting on side. She's sitting in a geographic -- or not geographically -- a different location in the communications system. She has a different detector. She has different electronics. She has a different physical layer because she's not sitting there with Bob with his equipment. So she's hearing different noise because she's getting different signal levels. And she doesn't know what threshold Bob has set his listening device to, his, his receiver. So, what happens is Bob has this set of values

from this long string of potential key values and Eve has a different set of values because she couldn't hear at all. In fact, Eve may be clever and she may hear certain values and retransmit them bumped up. So you know, so that Bob's more likely to hear them. But Bob could detect the error rate that's created because she's not hearing these things exactly. So when sometimes she makes a decision, she makes a bad decision as to whether it's binary one or binary zero and sends off the wrong information. So he gets an increased error rate and he can detect the presence of Eve. Now when Bob gets these values, he then goes back to Alice and says, Alice, I heard 1-3-7-12-15-23. Those are the values that I got. Then told Alice what the values are. Now, Eve, on the side, doesn't know this. So, out of this values, because Eve's sitting there saying, I heard 1-2-3-4-8, whatever the difference is, and she doesn't know how he was doing it, so they end up with different values. Eve cannot eavesdrop meaningfully and understand what the key value being conveyed to Bob is, because Bob is actually the judge of what key value he's going to use, and then conveys back certain information to Alice, who knows what she transmitted and is able to deduce what key Bob will be using and they start the cryptography. Noise is this application's friend. Now once you understand that that's the impetus of it, the noisy background, you see that the system doesn't depend on noise. It just has a very creative way of going about distributing the key, the cryptographic key. Now the <u>Meyers</u> patent -- we're in the anticipation world, there's only one, one rejection, one patent and it's anticipation -- is actually pretty much the polar opposite of what we're doing here. What <u>Meyers</u> is saying is it is a quantum cryptographic system, meaning that you're transmitting photons or electrons, depending on their spin, but it is a quantum effect. Now the one thing that is notable about quantum effects is they are binary in nature. They

either are present or they are not. There are not half values in quantum physics. Either the spin is this way or it's that way. Either the polarization is this way or it's not. It is a binary effect. So what happens in the Meyers patent is Alice sends out -- actually, I have to go through the background because it's easier to understand, then I'll, I'll talk about it, what Meyers innovation is. In the background system what you have in a cryptographic, quantum cryptographic system is single photons go out and they're detected. And there's basically four polarization states of these photons. Turns out the detectors are a little bit less than dynamic or a, a, a have a relatively narrow thing. They could only detect whether the polarization is orthogonal or they could detect whether it's at 45 degrees, what is called plus and x detectors. They can't do both for whatever reason. And it's not really explained in the Meyers patent. So what they basically set up is a situation where Alice sends out these photons and Bob is receiving them, chooses, randomly chooses which detector he's going to use. And either he detects something and he knows he chose the right detector for that particular instance, or he gets garbage, he gets nothing out of it. But then he conveys back to Alice the base, what they call base in this patent, meaning which detector they use. He didn't say what he saw, whether it's plus or minus in these polarization things, but he says, use x. Use plus. And that goes back to Alice, and Alice is able to establish the key. The problem with that system then is in the Meyers patent again, is that it requires an absolute perfect transmission. Noise will destroy it. And it says that very clearly. That's the problem that they're trying to address. The, the reason that quantum cryptographic systems are so marvelous is if Eve is in the middle and listens to it, because of the Heisenberg uncertainty principle, her listening to that photon, detecting what it is destroys the photon. Changes it's characteristic. And

that's the reason they can detect whether Eve is present, because the values that they are getting are unexpected. But the problem -- also in the background of the Meyers patent is that when these photons come out of the emitters, sometimes the emitters are a little bit loose and it's amidst two or three photons, or maybe many. And what'll happen is, Eve can put a beam splitter in there. One photon goes through. Quantum physics, you don't get half values. Either it goes through or it doesn't. But another photon would be reflected off to Eve. Eve detects it and she can detect the, the cryptographic key that's being distributed. So Meyers adds a level of complexity. They say, you know, rather than single photons, we're going to use this relation, this correlation between three photons, what they call GHC, after the name of the people that came up with this idea. So instead of one photon, they use three. Two of them stay with Alice, she detects what they are, knows what the bases are, sends a third one off to Bob. Bob gets the value. He knows what detector he uses is from those two bits of information. They then exchange the basis for the detection, not the values of what is measured. In fact, it's not values, it's a result of what's detect. Again, it's binary. It's either plus or minus. But it's not a value measurement. It's just an existence or a non-existence measurement. They exchange bases, they correlate this. They go through what is expected, and of those times, certain times they get the, the base is right. That is, the detectors are all correctly aligned and they can say, that was a good value and they keep that value. Now Eve, in the interim, doesn't know all this. She's watching it, she won't know what the GHR -- GHZR is, and presumably the detection of that single photon will be detected in the normal manner, as in the background section of the Meyers patent.

JUDGE JEFFERY: Counsel, let me, let me ask you a quick question --

MR. WIELAND: Sure.

JUDGE JEFFERY: -- here about this. That detection that is occurring, the photons. Is that measuring the decoded signal as plain? I mean, is there a dispute with respect to that --

MR. WIELAND: That is the focus.

JUDGE JEFFERY: -- limitation?

MR. WIELAND: It's at the end of the punch line, but that is --

JUDGE JEFFERY: As I understand, yeah, one of the key points of this dispute is a threshold value.

MR. WIELAND: Right.

JUDGE JEFFERY: Or lack thereof --

MR. WIELAND: Correct.

JUDGE JEFFERY: -- here. And that I understand your position that this detection of the signal and it's correspondence to one of the four bases is not having the measured value beyond a threshold value, which is predetermined and it's nearly a binary determination.

MR. WIELAND: You have it exactly. I don't need to be here.

JUDGE JEFFERY: But even -- well, I was going to say, but the concern that I have is, wouldn't even a binary determination involve some sort of comparison to a predetermined threshold to determine if it's one or the other?

MR. WIELAND: That's the, that is the magic here. In quantum physics that is not the case. The binary -- quantum means that there is a unit that is not dividable. The photon's there or it is not there. You can measure characteristics of it. And so what happens here is you have a detector, x or

plus detector, that will say this particular photon has this particular polarization. It's measuring a characteristic, but the -- there's no threshold because it is a binary state. It is either present or it is not present. And that's the, that's the key. You can't dial it in. You can't say, I got seven tenths of a photon. That doesn't exist. Is this -- there's no, there's no part values in quantum physics. That's the name of it. Quantum means there are no part values.

JUDGE JEFFERY: It's all or nothing --

MR. WIELAND: All or nothing.

JUDGE JEFFERY: -- and, but, but nothing and all, that to me involves some sort of predetermined determination whether it's all or nothing. I mean, it's an extreme comparison, if you will, but at the end of the day, it's -- you're, you're comparing what you get with a predetermined threshold.

MR. WIELAND: Right. And there's more to it, and you're focused on, you know, subparagraph C, where it says, bit by bit, base is having a measured value beyond a threshold value, which is predetermined. Then you have to look at E. Where the first and second users, I'm sorry. D -- I actually have a screwed up claim here, but it says D, it says, second user informing the first user of the bits adapted, or adopted, are the nth bits in the transmitted bit sequence, not telling the values of the bits. Now you see, again, values is about this measured seven tenths of what is expected for a binary one. And then you end it with paragraph E, which is taking the adopted bits as the key values and discarding the remaining ones. In the Meyers patent, what is exchanged is the basis, not the values. Now remember, in, in Meyers at the end, I mean, they can call nine, which is really the only relevant section. You have this thing where collate the basis,

the measuring techniques. They do not say what the values are and so that is a fundamental difference. I understand that, you know, when you read these claims, your just like, come on, is this a thresholding invention? But it's really very much more to that. There's a subtlety to the claims that takes some explaining, hence, why I'm here.

JUDGE DIXON: So you'd say that that rough sort of present or not present is not a threshold?

MR. WIELAND: No, I don't think it is, and not in the context of these claims. Not in the context of this invention.

JUDGE DIXON: Um-hum.

MR. WIELAND: And not, not in the meaning of quantum physics. There's no thresholding here. I, I thought --

JUDGE DIXON: Well, wasn't there, as Judge Jeffery was saying, present or not present, that's a threshold. You're over something. Infinitesimal, it's either not there, or how do you determine it's not there? By it is there, so you had to find that it was greater than nothing. So --

MR. WIELAND: You're saying the threshold is zero. It's either zero or it's not, but I don't know if you can -- I don't -- I think that's too far -- first, the phrase is threshold value. Value has meaning here. But I think --

JUDGE DIXON: Zero is value, isn't it?

MR. WIELAND: Well, threshold value means something more than zero or one.

JUDGE DIXON: It is?

MR. WIELAND: Yeah. I don't think you can -- I think just the plain meaning of the phrase tells you that. Threshold value suggests that it's not just binary zero, binary one. Meaning, if you're saying that, then basically what you're saying is then you're conveying the, the, the values back to the,

the -- well, let's go through this. If you're saying a binary one, let's say the spin state is x positive x. And what the, the being conveyed from Bob back to Alice is, I used the x detector. Okay? That threshold value isn't being used there. He's just saying, I used this as a base. So you have a disconnect between the measured values and what's actually conveyed. But more importantly, I really have a hard time saying threshold value which, you know, has to mean something other than binary states, because in quantum physics, you don't say, I got, I mean, I think you, you, you're confusing or you're suggesting that threshold -- and I didn't mean to just say confusing -- you're suggesting that threshold and gate keeping are the same thing. And that's not the same thing. Threshold has to -- remember, the threshold should be set so I, I would say, you know, if you, if you had to go to this extent, you could say, go on back to the spec. I know that we're talking about something other than binary states. And the Examiner didn't even suggest that was the case. He said it was inherent that you're throwing out a threshold, and I don't think he was fully aware of the quantum nature or the implications of quantum aspects of this Meyers patent. Can I go on to claim two, or I'm glad to stay here and -- I think I'm out of time almost, so.

JUDGE DIXON: Continue. No. Continue.

MR. WIELAND: Claim two, I, you know, I don't actually think that there is much argument about. They both do a statistical analysis. Examiner, I would say, points to the wrong section of Meyers. If you're going to look at something, I would look at column nine, lines 29 through 44. That is the over layer where you're now doing some form of statistical analysis on the error rate. Claim three, there was an attempt to, to define around quantum physics, but I'm not sure it gets us there. Claim four, mutual modulated noise by another transmitter. Meyers is pretty clear,

saying, that this has to be a fairly pure system. So it's not a multiple access system. And you're not going to have intermodulations, particularly since it's quantum physics, and that doesn't really happen. Claim five and six, I've read that section numerous times where he, he cites to it and I don't, I just don't see it. I, I, I'm not sure what he's getting at there. But in any event, they are dependent claims. But it just seems that he cited the wrong section for that.

JUDGE DIXON: But you didn't argue all those dependent claims separately?

MR. WIELAND: I did, actually. I -- the only one I didn't argue separately was claim three. And that -- I just couldn't put a polish on that.

JUDGE DIXON: Claim three?

JUDGE JEFFERY: Page eight.

MR. WIELAND: You know, there's a sense of this, and I think my sense of it is this isn't so much about the two disclosures being the same, that they're disclosing the same invention. It's more about a labor of claim language. And they -- we, we submit to the claims actually capture our invention and are not so broad as to capture the Meyers type system.

JUDGE JEFFERY: Okay.

MR. WIELAND: Gentleman, I thank you for your time. If there's any -- oh, sorry.

JUDGE DIXON: There's one more question. Going back to claim one in, in subparagraph D, where we call for the second user informing the first of the -- in defense of the sequence, so we have to identify exactly where -- I just want to make sure clarify that point, that it has to be a particular point in the sequence that must be informed. The user has to inform the other about.

MR. WIELAND: Yes.

JUDGE JEFFERY: Okay.

MR. WIELAND: I, you know, if this, if this was my application, I would write the claims differently, too, but that is the meaning of that phrase, and, and we haven't had a problem with the examiner in that regard.

JUDGE DIXON: All right.

JUDGE JEFFERY: Okay. Thank you. Any questions?

UNIDENTIFIED SPEAKER: May I have Ms. Sculia (phonetic sp.) first and last name, please?

MR. WIELAND: I'll just give you a card. It is -- if there's nothing else, gentlemen, I thank you for your time. Been fun.

JUDGE JEFFERY: Thank you.

(Whereupon, the proceedings concluded.)